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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/562,518	06/20/2006	Ralf Jonczyk	357393.00007	7947

78905 7590 03/22/2011

Saul Ewing LLP (Philadelphia)
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Penn National Insurance Plaza
2 North Second Street, 7th Floor
Harrisburg, PA 17101

EXAMINER

MOWLA, GOLAM

ART UNIT	PAPER NUMBER
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1723

MAIL DATE	DELIVERY MODE
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03/22/2011

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/562,518	JONCZYK ET AL.	
	Examiner	Art Unit	
	GOLAM MOWLA	1723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Withdrawal of Finality

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Response to Amendment

2. Applicant's argument of 03/08/2011 overcomes the rejection as presented in the Office Action dated 12/22/2010, and therefore, the finality of the last Office action is withdrawn.
3. Claims 1-18 are currently pending.

Status of the Rejections

4. The rejections of claims 1-16 from the Office Action dated 12/22/2010 are withdrawn in view Applicant's persuasive argument.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. Claims 1-2 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Imura et al. (US 5,327,007).

Regarding claims 1-2 and 13, Imura teaches a silicon semiconductor substrate (Si wafer 1) (fig. 1) (4:40-54) having a first major surface (top surface), a second major surface opposite the first major surface (bottom surface), and an edge region connecting the first and second major surfaces (inherent features of a structure or any layer). Imura further discloses the silicon semiconductor substrate (1) has a zone (7a) of reduced interstitial oxygen concentration of $2-3 \times 10^{17}$ atoms/cm³ (see table 3) ([0047]), which is not greater than 3×10^{17} atoms/cm³ as required by the instant claims, to a depth of about 100 μ m from the first major surface (top surface) of the substrate (1). Imura further discloses that said semiconductor element (1) has a thickness of 530 μ m (4:40-54).

7. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Saito (US 5,923,071).

Regarding claims 1-5, Saito teaches a silicon semiconductor substrate (Si film) (col. 4, lines 45-47) having a first major surface, a second major surface opposite the first major surface, and an edge region connecting the first and second major surfaces (inherent features of a film or any layer). Saito further discloses the silicon semiconductor substrate (Si film) has a zone of reduced interstitial oxygen concentration of not greater than 3×10^{17} atoms/cm³ to a depth of about 75-175 μ m from the first major surface of the substrate (col. 4, lines 45-47).

Claim Rejections - 35 USC § 103

8. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saito as applied to claim 1 above, and further in view of Tachikawa et al. (US 2003/0056715 A1).

Applicant is directed above for complete discussion of Saito with respect to claim 1, which is incorporated herein. Saito further discloses the silicon semiconductor substrate (Si film) has a zone of reduced interstitial oxygen concentration has a depth of below 200 μm from the first major surface of the substrate (col. 4, lines 45-47). Although Saito is silent as to whether said zone of reduced oxygen has a depth of 200 μm from said first major surface, one skilled in the art would have expected the Si film to have the same properties when the depth is below 200 μm (for example 199 μm) or 200 μm , and therefore, a prima facie case of obviousness exists (Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)) (MPEP §2144.05 I).

10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Imura as applied to claim 1 above, and further in view of Tachikawa et al. (US 2003/0056715 A1).

Applicant is directed above for complete discussion of Imura with respect to claim 1, which is incorporated herein. Imura is silent as to whether said zone of reduced oxygen (7a) includes at least one member selected from the group consisting of at least 10^{15} atoms/ cm^3 or more of nitrogen, at least 10^{17} atoms/ cm^3 or more of carbon, and one or more transition metal elements in a total amount of at least 10^{16} or more atoms/ cm^3 .

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Tachikawa teaches a silicon semiconductor substrate having a first major surface, a second major surface opposite the top surface, and an edge region connecting the first and second major surfaces (inherent features of a structure or any layer). Tachikawa further discloses the silicon semiconductor substrate has a zone of reduced interstitial oxygen concentration ($[O_i]$) of, for example, 2.8×10^{16} - 6.0×10^{16} atoms/cm³ (see table 3) ([0047]) and a nitrogen concentration in the range of 5×10^{14} - 1×10^{16} atoms/cm³ (see [0030]). Tachikawa's silicon semiconductor substrate provides the advantage of an improved defect-free zone ([0001-0005]).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to have utilized a nitrogen concentration in the range of 5×10^{14} - 1×10^{16} atoms/cm³ as taught by Tachikawa in the zone of reduced oxygen concentration (7a) of Imura in order to allow for a silicon semiconductor substrate having improved defect-free zone, as taught by Tachikawa ([0001-0005]) and also desired by Imura (7:24-29).

Imura in view of Tachikawa discloses that the silicon substrate have a nitrogen concentration in the range of 5×10^{14} to 1×10^{16} atoms/cm³ (see [0030]), which overlaps with the claimed range (10^{15} or more nitrogen atoms/cm³) of nitrogen concentration. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (MPEP § 2144.05, In re Wertheim).

11. Claims 1-2, 8, 13 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gee (US 5,468,652) in view of Imura et al. (US 5,327,007).

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Regarding claims 1-2, 8, 13 and 17-18, Gee teaches a metal wrap through solar cell with holes (20) extending from the first major surface to the second major surface of silicon semiconductor substrate (24) (see col. 2, line 55 through col. 3, line 46; and Figure 1).

Gee teaches the limitations of the instant claims, the difference being that Gee does not specifically teach that its silicon semiconductor substrate (24) can have the instant zone of reduced oxygen concentration.

Imura teaches a silicon semiconductor substrate (Si wafer 1) (fig. 1) (4:40-54) having a first major surface (top surface), a second major surface opposite the first major surface (bottom surface), and an edge region connecting the first and second major surfaces (inherent features of a structure or any layer). Imura further discloses the silicon semiconductor substrate (1) has a zone (7a) of reduced interstitial oxygen concentration of $2-3 \times 10^{17}$ atoms/cm³ (see table 3) ([0047]), which is not greater than 3×10^{17} atoms/cm³ as required by the instant claims, to a depth of about 100 μ m from the first major surface (top surface) of the substrate (1). Imura further discloses that said semiconductor element (1) has a thickness of 530 μ m (4:40-54). Imura's silicon semiconductor substrate provides the advantage of excellent gettering effect (1:5-9) and fewer defects (7:24-29).

It would have been obvious to one of ordinary skill in the art to have used Imura's silicon semiconductor substrate for the silicon semiconductor substrate in Gee's solar cell because Imura's silicon semiconductor substrate provides the advantage of excellent gettering effect (1:5-9) and fewer defects (7:24-29).

Regarding claim 16, the determination of an appropriate surface area for Gee's in view of Imura's semiconductor substrate would have been within the skill of an artisan. In the case where

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the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (MPEP § 2144.05 IIA, In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

12. Claims 1-2 and 9-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tange (US 6,005,185) in view of Imura et al. (US 5,327,007).

Regarding claims 1-2, 9-15 and 17-18, Tange teaches a solar cell (10) formed from a silicon wafer having a thickness of 300 to 700 μm , wherein the wafer surface has ridges and valleys at reference sign (16); and has a portion near reference sign (14) at the perimeter that is thicker than the rest of the wafer (see col. 2, line 45 through col. 3, line 50; and Figure 1).

Tange teaches the limitations of the instant claims, the difference being that Tange does not specifically teach that its silicon wafer can have the instant zone of reduced oxygen concentration.

Imura teaches a silicon semiconductor substrate (Si wafer 1) (fig. 1) (4:40-54) having a first major surface (top surface), a second major surface opposite the first major surface (bottom surface), and an edge region connecting the first and second major surfaces (inherent features of a structure or any layer). Imura further discloses the silicon semiconductor substrate (1) has a zone (7a) of reduced interstitial oxygen concentration of $2-3 \times 10^{17}$ atoms/ cm^3 (see table 3) ([0047]), which is not greater than 3×10^{17} atoms/ cm^3 as required by the instant claims, to a depth of about 100 μm from the first major surface (top surface) of the substrate (1). Imura further discloses that said semiconductor element (1) has a thickness of 530 μm (4:40-54). Imura's

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silicon semiconductor substrate provides the advantage of excellent gettering effect (1:5-9) and fewer defects (7:24-29).

It would have been obvious to one of ordinary skill in the art to have used Imura's silicon semiconductor substrate for the silicon wafer in Tange's solar cell because Imura's silicon semiconductor substrate provides the advantage of excellent gettering effect (1:5-9) and fewer defects (7:24-29).

Regarding claim 16, the determination of an appropriate surface area for Tange's in view of Imura's semiconductor substrate would have been within the skill of an artisan. In the case where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (MPEP § 2144.05 IIA, In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

Response to Arguments

13. Applicant's arguments with respect to claims 1-16 have been fully considered but they are moot in view of new ground of rejection as presented above. not persuasive.

On page 2 of Remarks, Applicant argues that Tachikawa fails to disclose a silicon semiconductor substrate having a zone of reduced interstitial oxygen concentration not greater than 3×10^{17} atoms/cm³ to a depth of 75-200 μm as required by the claims 1-18.

This argument is persuasive and is moot in view of new ground of rejection as presented above.

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Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-Th, 0800-1830 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ALEXA NECKEL can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/G. M./
Examiner, Art Unit 1723

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1723